

REMARKS

The Office Action dated November 1, 2006 has been received and carefully noted. The above amendments to the claims, and the following remarks, are submitted as a full and complete response thereto.

Claim 3 has been amended to more particularly point out and distinctly claim the subject matter of the invention. No new matter has been added. Claims 1-3 are respectfully submitted for consideration.

The Office Action rejected claims 1-3 under 35 U.S.C. §103(a) as being unpatentable over Steinbrenner (U.S. Patent No. 4,541,390) in view of Uemura (U.S. Patent No. 6,575,143). The Office Action took the position that Steinbrenner discloses all of the elements of the claims, with the exception of using the generator as the power supply for the fuel injection system. The Office Action then cites Uemura as allegedly curing this deficiency in Steinbrenner. The rejection is respectfully traversed for the reasons which follow.

Claim 1 recites an engine start control device capable of starting upon receiving generated power from a generator which is driven by a starter. The engine start control device includes a fuel injection timing setting device which makes a power generation waveform of said generator correspond to a crank pulse signal, and outputs a fuel injection signal to an injector for injecting fuel to said engine in conformance with a crank pulse signal for when a voltage of said generated power reaches a peak value after a starting operation of said starter.

Claim 2 recites an engine start control device capable of starting upon receiving power generated from a generator which is driven by a starter. The engine start control device includes an offset time measuring device which measures an offset time of a peak timing of a voltage generated by a generator with respect to a crank pulse signal, immediately after a starting operation of the starter, and a fuel injection timing setting device which outputs a fuel injection signal to an injector for injecting fuel to said engine, after said offset time has elapsed after the crank pulse signal has been output.

Claim 3 recites a start control method for an engine capable of starting upon receiving generated power from a generator which is driven by a starter. The method includes measuring an offset time of a peak timing of a voltage generated by a generator with respect to a crank pulse signal, immediately after a starting operation of said starter, and outputting a fuel injection signal to an injector for injecting fuel to said engine, after said offset time has elapsed after the crank pulse signal has been output.

Thus, according to embodiments of the invention, it is possible to inject fuel from the injectors, in conformance with a time when the voltage generated by the generator, which changes cyclically in accordance with the crank pulse signal, reaches a peak. As a result, it is possible to start the engine in a short time after the starting operation, and at a time where the supply voltage to the injectors reaches a sufficient level.

As will be discussed below, the cited prior art fails to disclose or suggest all of the elements of the claims, and therefore fails to provide the advantages and features discussed above.

Steinbrenner discloses a method and apparatus for determining an injection moment during a start process of an internal combustion engine with an intermittent fuel injection and provided with a main power supply, a battery, a crank shaft and a fuel injection valve. The method includes controlling a time point for the injection valve by shifting the time point of the injection valve control for a delay period of time or a delay-angle depending upon the number of revolutions of the crank shaft or upon the voltage of the battery so that the time point occurs approximately within a following maximum value of a cyclically fluctuating voltage of the main power supply depending upon the number of revolutions of the crank shaft or the maximum voltage of the battery.

Uemura discloses a batteryless fuel injection apparatus for a multi-cylinder internal combustion engine comprising an injector provided for each of cylinders of the multi-cylinder internal combustion engine having n cylinders to open a valve when a drive current of valve opening level or higher is applied to the valve to inject a fuel, a generator driven by the internal combustion engine, an electric power circuit to generate a predetermined DC voltage using the generator as an electric power source, and a signal generation device to generate a reference pulse signal for each of the cylinders at a reference rotational angle position set relative to each of the cylinders.

Applicants respectfully submit that Steinbrenner and Uemura, whether viewed individually or combined, fail to disclose or suggest all of the elements of the present claims. For example, the combination of Steinbrenner and Uemura fails to disclose or suggest “a fuel injection timing setting device which makes a power generation

waveform of said generator correspond to a crank pulse signal, and outputs a fuel injection ... in conformance with a crank pulse signal for when a voltage of said generated power reaches a peak value after a starting operation of said starter,” as recited in claim 1. Similarly, Steinbrenner and Uemura do not disclose or suggest “an offset time measuring device which measures an offset time of a peak timing of a voltage generated by a generator with respect to a crank pulse signal...and a fuel injection timing setting device which outputs a fuel injection signal to an injector for injecting fuel to said engine, after said offset time has elapsed after the crank pulse signal has been output,” as recited in claim 2. Additionally, the combination of Steinbrenner and Uemura fails to disclose or suggest “measuring an offset time of a peak timing of a voltage generated by a generator with respect to a crank pulse signal, immediately after a starting operation of said starter,” and “outputting a fuel injection signal to an injector for injecting fuel to said engine, after said offset time has elapsed after the crank pulse signal has been output,” as recited in claim 3.

According to embodiments of the present invention, therefore, an engine start control device capable of starting upon receiving generated power from a generator, which is driven by a starter, is provided. The engine start control device includes a fuel injection timing setting device which makes a power generation waveform of the generator correspond to a crank pulse signal, and outputs a fuel injection signal to an injector for injecting fuel to the engine in conformance with a crank pulse signal for when a voltage of the generated power reaches a peak value after a starting operation of the

starter (Specification, page 2, lines 10-16). As a result, according to an embodiment of the invention, it is possible to measure the time difference between a crank pulse signal and a peak of the generated voltage, and inject fuel from the injector 4 when the voltage generated by the generator 13 reaches a peak, after the crank pulse signal has been output. Therefore, it is possible to start the engine in a short time after the starting operation, and at the time that the supply voltage to the injector 4 reaches a sufficient level (Specification, page 7, lines 7-12).

Steinbrenner, on the other hand, only discloses shifting the time point of the injection valve control for a delay period of time or a delay-angle depending upon the number of revolutions of the crank shaft or upon the voltage of the battery so that the time point occurs approximately within a following maximum value of a cyclically fluctuating voltage of the main power supply depending upon the number of revolutions of the crank shaft or the maximum voltage of the battery (Steinbrenner, Column 1, lines 60-68). Steinbrenner further discloses that, due to the timely shifting or delay of the start of the fuel injection towards the respective voltage maximum of the main power supply, it is ensured that the maximal value of the voltage of the main power supply always occurs at the time point of the shifted fuel injection start (Steinbrenner, Column 2, lines 25-33).

However, Steinbrenner does not disclose or suggest a fuel injection timing setting device which makes a power generation waveform of the generator correspond to a crank pulse signal, and outputs a fuel injection in conformance with a crank pulse signal. As

discussed above, examples of the present invention measure the time difference between a crank pulse signal and a peak of the generated voltage, and inject fuel from the injector 4 when the voltage generated by the generator 13 reaches a peak, after the crank pulse signal has been output. Steinbrenner fails to disclose or suggest these elements of the claimed invention.

Additionally, Uemura does not cure these deficiencies in Steinbrenner. Uemura, as discussed above, merely discloses a generator driven by the internal combustion engine, an electric power circuit to generate a predetermined DC voltage using the generator as an electric power source, and a signal generation device to generate a reference pulse signal for each of the cylinders at a reference rotational angle position set relative to each of the cylinders. Uemura, like Steinbrenner, does not make any mention of measuring the time difference between a crank pulse signal and a peak of the generated voltage, and injecting fuel from the injector 4 when the voltage generated by the generator 13 reaches a peak, after the crank pulse signal has been output.

Therefore, the combination of Steinbrenner and Uemura fails to disclose or suggest all of the elements of claims 1-3. For at least the reasons discussed above, Applicants respectfully request that the rejection of claims 1-3 be withdrawn and this application passed to issue.

As outlined above, Applicants respectfully submit that the cited prior art fails to disclose or suggest all of the elements of the claimed invention. These distinctions are more than sufficient to render the claimed invention unanticipated and unobvious. It is therefore respectfully requested that all of claims 1-3 be allowed, and this application passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,



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